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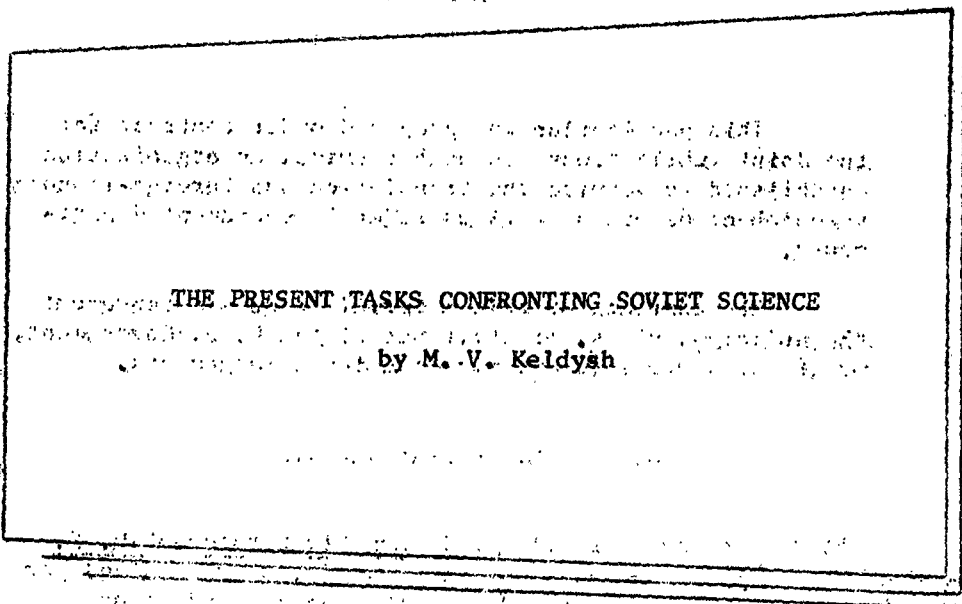
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FOREWORD

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THE PRESENT TASKS CONFRONTING SOVIET SCIENCE

[Following is the translation of an article by the Academician M. V. Keldysh, President of the USSR Academy of Sciences, in the Russian-language publication Pravda, 28 October 1962, page 3.]

The Program of the CPSU which was passed at the 22nd Party Congress and which lays out a magnificent plan for building communism in our nation has opened up grandiose prospects for Soviet science. During the period of the full-scale construction of communism, when science will completely become a direct productive force, its achievements must be used for creating the material-technical basis of communism. Social sciences in becoming the scientific basis for directing the development of society must at the same time provide a further rise in the level of popular education and culture in our nation.

In order to carry out the grandiose progress in all branches of production which is necessary for creating the material-technical basis of a communist society, we must achieve a much higher labor productivity. Here an extremely important role will be played by science. The Party has greatly raised the significance of science in the nation, in guiding the scientists to the greatest possible development of theoretical research in constant contact with the tasks of communist construction.

The achievements of Soviet science and technology are doing more and more to strengthen the international prestige of the Soviet Union. The Party Program places the very responsible task of "strengthening through Soviet science the advanced positions which we have won in the important branches of knowledge, and to assume a leading position in world science in all basic directions."

History has never known such an impelling development of human society as is in our times. The consolidation and expansion of the world socialist system, the successful struggle of the colonial peoples for national independence and the deepening of the general crisis in capitalism clearly demonstrate the historical correctness and great vital strength of Marxism-Leninism.

The twentieth century is characterized not merely by socialist revolutions, but also the revolution in natural sciences as was pointed out by V. I. Lenin. The rates for the development of industry, technology, science and culture in the modern era are truly fantastic. In the next few years our advancement will become even greater.

We must construct the most perfect society in the history of humanity which is communism. For this, we must have advancement in all branches of production and culture.

Of determining significance in the development of all branches of the national economy and in creating the material-technical basis of a communist society is the electrification of the nation. In the coming two decades, electrical production in the nation should increase by 800-900%. In solving this colossal task, a basic role must be played by the engineering sciences which must find new paths for increasing economicalness both in the process of producing the electric power and also in its transmission and consumption. Raising the technical-economic indices in the thermal and hydroelectric stations, transmission lines and equipment which use electric power can be achieved by building large and major power stations, by creating electric units with an ever-increasing capacity and with a transition to a higher parameter for the working processes, by creating super-high-powered direct and alternating current transmission on super-high voltage lines, and by devising automatic control and regulating systems for the power units, and more effective electrical machinery and equipment. This presupposes the use of particularly durable manufacturing materials for the protracted work under conditions of high temperatures and mechanical tension, and new types of thermal and electrical insulating materials for machinery and equipment.

It is generally known that the reserves of organic fuel in the earth and the hydroelectric resources are limited, although by improving the physical methods of surveying it has been possible to sharply increase the discovered fuel reserves, particularly for oil and gas. However, harnessing the energy of fissionable nuclei of heavy elements has made it possible to increase several times the power resources. Along with improving the ordinary methods of supplying electrical power, great possibilities for more effectively using the existing power resources can be found in the methods of a direct conversion of thermal and chemical energy into electric power. And the realization of a controlled thermal-nuclear reaction will open up virtually inexhaustible sources of energy.

The deeper science penetrates into the minute structure of material, the more powerful the forces of nature become for us, and the more refined new and very rich possibilities for using the forces of

nature in the good of mankind.

Research on the laws of interaction of "elementary particles" can lead not only to a revision of the basic concepts in modern physics on the structure of materials. Penetrating the secrets of a compound's structure and a knowledge of the deeper properties of a compound can open up extensive prospects for transforming nature.

A very important task in modern science is to improve the properties of natural materials and to create new materials. Technological progress in the majority of branches in the national economy and the satisfaction of the growing demands of people during our times and more even during the future is unthinkable without new materials which surpass in terms of their properties the natural ones, and as well we must have new methods for obtaining them. A leading role in solving this task will be played by solids physics and chemistry.

The possibility of creating up-to-date machinery and equipment for the most diverse branches of industry and transportation, radio electronic instruments and computers is closely linked with the advances in solids physics which is becoming a scientific basis for the leading branches of technology. Solids physics opens up extensive possibilities for obtaining compounds with fixed properties, in particular those which possess high durability, hardness, fire resistance, semiconductor and magnetic properties, corrosion resistance, etc. Here a clear result was the manufacturing of artificial diamonds from graphite.

The creation of new types of crystals with admixtures of different compounds plays an important role in radio engineering, and in electronics, and particularly in quantum electronics which will be very important not only in radio communications but in manufacturing.

Using the properties of semiconductor crystals has led to further progress in electronics. The use of semiconductor crystals, along with increasing the reliability and decreasing the amount of energy required makes it possible to decrease by a thousand times the size of the electronic instruments. Even greater possibilities in miniaturization can be found in a new direction in electronics which is molecular electronics.

As a result of a deep penetration into the atomic-molecular structure of compounds, significant advances have been made in creating new materials by chemistry. Very recently we have discovered ways to manufacture synthetic fabrics from hard coal and natural gas. And even now the clothing from synthetic fabrics is frequently better than that manufactured from natural materials such as wool, cotton and flax. The chemists have created many new synthetic materials for the most different branches of industry, transportation, construction and living needs. They combine great stability and the ability to withstand high

temperatures, flexibility, weather resistance, etc.

New methods have been worked out for obtaining polymers which have made a significant contribution to solving the task of creating synthetic materials with fixed properties. Thus, by the method of stereospecific polymerization we have been able to obtain new types of synthetic rubber which in terms of its property is equal to natural rubber, and we have also created a number of new polymer materials. The methods of chemical modification and fixation make it possible to improve the properties of natural materials and to obtain synthetic materials with new practically useful properties. It is particularly important to obtain polymers with a high degree of purity.

Biological science will be of great assistance to agriculture, public health and a number of branches of the light and food industries. Soviet scientists and workers in seed selection have grown remarkable types of wheat, cotton, corn, sunflowers, sugar beets and other agricultural crops which provide high and constant harvests. Far to the north they have grown new types of vegetables and fruit crops. They have obtained highly productive sorts of agricultural livestock.

The further development of agriculture is unthinkable without introducing intensive systems of agriculture, closely allied with the mechanization and chemization of agricultural production. Chemical means such as fertilizers, weed killers, growth stimulators, insecticides and others make it possible to increase harvest yield for agricultural crops and the mechanization of labor-intensive processes in agricultural production, thereby raising labor productivity. The scientists must pay particular attention to finding new highly effective types of fertilizers and weed killers and to using microelements. They are expanding their search for new weed killers. We have obtained, for example, weed killers which are designed to combat weeds growing in corn, flax, certain cereal and industrial crops.

In the next few years we will carry out the extensive chemization of agriculture. The creation of new highly effective preparations and their correct utilization is only possible with a thorough knowledge of the biological and physical-chemical processes in the soil and plants.

The use of scientifically based methods for feeding animals makes it possible to significantly increase the productivity of animal husbandry with a saving in fodder. This to a great degree will be aided by the use of vitamins, antibiotics, enzymes and other physiologically active preparations. It is generally known that such vitamins as A, B, and B₁₂ basically raise the productivity of animals. A new method which has been worked out in the USSR Academy of Sciences for producing a cheap vitamin B₁₂ makes it possible to extensively introduce it into practice in the near future.

Of greater and greater significance in the national economy and public health is the extensive utilization of microorganisms for producing food and fodder products, vitamins, antibiotics and different types of pharmaceuticals.

The efforts of the scientists are concentrated on solving all of these questions directly linked with the main task of our nation's agriculture which is to create an abundance of food products for the population and agricultural raw products for industry.

Our nation is giving great attention to the sciences serving the health of man. The development of physiology, virology, microbiology, biochemistry and biophysics makes it possible to find more effective methods for combatting human diseases, and to solve the problem of curing cancer, cardio-vascular and other diseases. In surgery they are using instruments which replace the heart, lungs and kidneys during treatment and operations.

We must also note that biological research in its turn aids the development of technology which uses the principles of biological processes in creating modern computer equipment.

The use of research methods in biology which are based upon the achievements of physics, chemistry and mathematics makes it possible to more fully understand the nature of the biological processes. Science is penetrating deeper and deeper into the molecular structure of cells and is studying the elementary physical-chemical processes which occur in the cell, and is showing the relationship between the physical-chemical structure of cell elements and their biological functions.

There can be no doubt that in biology, as in physics and chemistry, a thorough penetration into the delicate structural and molecular processes will lead to new great discoveries. Even now major advances have been noted in discovering such secrets of living nature as the biosynthesis of albumin, the control of inheritance, immunity, and photosynthesis.

Of course, we must not think that the elementary physical-chemical processes can explain all phenomena of life. In the world of physical phenomena, elementary processes also do not determine everything; much can be discovered, for example, only on the level of statistical patterns. However, just as with physics and chemistry, a knowledge of the elementary processes in biology opens up unforeseen possibilities for progress. The knowledge of the patterns which determine the life activity of a cell and an organism will make it possible for the scientists to directly influence the processes of growth and the development of plants and animals.

Cybernetics will have a great influence upon science and production. Electronic computers play a decisive role in cybernetics. During the

short period of time since the appearance of the first electronic computer, much that is fundamentally new has arisen in production. They are using equipment with programmed control. They have found possibilities of introducing cybernetics into transportation control, production processes control, accounting and planning for the national economy.

It is generally recognized that man's conquering of outer space opened up a new era in harnessing the forces of nature. The successes of Soviet science and technology in developing outer space show the large achievements in the area of mechanics, mathematics, radio engineering, chemistry, space biology, and also the high general level of natural and engineering sciences in our nation. The launching of Soviet sputniks and space rockets, and the flights of the hero-astronauts in our spaceships are only a beginning in conquering outer space. The conquering of outer space opens up extensive horizons in science.

The Party has raised the task of making science the property of the masses. Therefore it is very important to popularize the achievements of science on the pages of the press. The greater the range of people who know the achievements of science, the easier these achievements will be supported in life. The treatment of scientific problems and the achievements of science and technology in Pravda and in all of our press is of enormous significance. There can be no doubt that our scientists are responding widely to the call of Pravda and are taking active participation in its section on "The World of Science."